

reports

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Dear NCSE members,

It's that time of year again, a time for reflection, for patting ourselves on the back for the accomplishments of the last year, and for setting new goals for the next year. On this issue's back cover, we make light of this process, and recognize that when we overpromise, our resolutions are doomed to fail. And so, we propose that you make at least one resolution that's easy to keep: renew your annual membership with NCSE.

At NCSE, our goals are to ensure that all students learn about evolution and climate change without compromise or debate in every science classroom in the United States. That every teacher will have the support and expertise they need to make that happen. That every community will have access to high-quality, friendly, authentic, hands-on climate change and evolution activities. That efforts to dilute science standards or legislate the teaching of "both sides" will all be blocked whenever they arise. In all fifty states, all 13,000-plus school districts—in hundreds of thousands of classrooms, for millions of students.

And you know what? We know that we won't be able to fully achieve our goals this year. But just as knowing that you probably won't go to the gym 413 times this year shouldn't stop you from going at all, the fact that we won't fully achieve our goal won't stop us from making progress. I can assure you that with your support, we will have done everything we can to support teachers and communities so that evolution and climate change are consistently presented accurately and confidently. Our future citizens deserve no less, whether they grow up rich or poor, in blue states or red states, in religious families or secular ones. Thinking like a scientist is a powerful tool that we want every citizen to wield with confidence.

Since coming to NCSE, my annual resolutions have been to think only good thoughts about the future of science education, to always remember that parents and community leaders everywhere want the best for their kids, and that, fundamentally, there is much more that unites us than divides us. These haven't been the easiest resolutions to keep in the past year, but they're the most important ones I can make.

Because of your help, NCSE can look back on 2017 with pride and toward 2018 with optimism. Thank you for all of your encouragement, kind words, and, of course, donations, whether of time or money. We resolve to continue to put your positive energy and support to the best possible use—and that is one resolution we know we can keep.

Sincerely,



Ann Reid is the
executive director of NCSE.
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ncse

BY THE NUMBERS

2017

MEMBERSHIP

3,762 members

314 lifetime members
391 sustaining members

RALLYING THE TROOPS

6 anti-science bills defeated
AR, IA [two], OK, SD, TX

8 states in which NCSE mustered support for quality science standards
CO, ID, LA, NE, NM, OH, TX, WI

SCIENCE BOOSTER CLUBS

50 active volunteers collectively putting in at least 150 hours per week

15 Clubs with 1,540 members

10 teaching grants, benefiting 3,300 students

104,910 attendees at SBC events

NCSEteach

6,214 teachers enrolled covering all 50 states

64 teacher-scientist matches in 21 states

Excitement, and Eventual Enlightenment, in the Land of Enchantment

The state of New Mexico underwent about five weeks of intense controversy over its state science standards during the fall of 2017, after the Public Education Department (NM-PED) released a draft set of science standards for public comment. Although modeled on the performance expectations of the Next Generation Science Standards, the proposed standards lacked important elements of the NGSS (such as disciplinary core ideas, science and engineering practices, and cross-cutting concepts), were diluted with dozens of New Mexico-specific standards, and—of particular concern to NCSE—underwent editing to weaken their treatment of evolution, climate change, and the age of Earth.

For example, a middle school standard about embryology's relevance to evolution was omitted altogether, while "biological diversity" was inappropriately substituted for "evolution" in a high school standard. A different high school standard calling for students to "[c]ommunicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence" was revised to call for students to "[a]nalyze, interpret, and communicate" such scientific information. The change offers the opportunity for evolution's detractors to present, or request the presentation of, misinformation under the guise of analysis and interpretation.

Climate change was targeted as well. References to the rise in global temperatures and global climate change were revised to claims about "fluctuations" in two standards. So eager were the editors to pander to climate change deniers, in fact, that they added two clauses to forestall the possibility of discussing anthropogenic climate change in one standard—"Use a model to describe how variations in the

flow of energy into and out of Earth's systems that were caused by natural occurrences that are not related to human activity" (emphasis added)—apparently without noticing the redundancy. And perhaps lest young-earth creationists feel neglected, a reference to "Earth's 4.6 billion year old history" was changed to "Earth's geologic history."

The NM-PED was not responsive to questions about the provenance of the revisions that compromised the scientific integrity of the standards. I told *Mother Jones* ([September 15, 2017](#)) that the revisions were "evidently intended to placate creationists and climate change deniers." A former employee of the department corroborated my diagnosis when she later told *Mother Jones* ([October 6, 2017](#)) that her superiors—including former Secretary of Education Hanna Skandera and the present Secretary-Designate of Education Christopher Ruszkowski—insisted on the revisions because they "were really worried about creationists and the oil companies." The employee resigned in protest.



David E. Thomas explaining geochronology at the Santa Fe, New Mexico teach-in on October 13, 2017. Photo: Steven Carrillo

Reaction to the proposed standards was quick and uniformly negative, with criticism from organizations of educators (including the New Mexico Science Teachers' Association), scientists (including sixty-one scientists at Los Alamos National Laboratories who, led by Greg Swift [see *Random Samples*, p. 5], purchased a full-page newspaper advertisement to make their objections known), local school boards and school superintendents, politicians (including both of New Mexico's senators), and newspapers (including the *Albuquerque Journal*, the *Las Cruces Sun-News*, and the *Santa Fe New Mexican*). Additionally, a teach-in was held outside the Public Education Department in Santa Fe on [October 13, 2017](#).

Critics of the proposed standards often—although not always—called for the adoption of the NGSS in their entirety and without edits. There was perhaps a sense of lost opportunity at work here. Earlier, in the spring of 2017, House Bill 211, a measure to require the state to adopt the NGSS, passed both houses of the legislature but was vetoed by Governor Susana Martinez on the grounds that “such standards do not belong in permanent statute ... This legislation would make it more difficult to update science standards.” She explained, “The Public Education Department has already been working diligently to route the standards through the appropriate vetting process”—ironic in retrospect.

On October 16, 2017—the last day of the public comment period—the NM-PED held a public hearing on the standards in Santa Fe. A string of concerned New Mexicans expressed their opposition to the proposed standards, virtually without exception. As NM Political Report ([October 17, 2017](#)) noted, “People started arriving an hour-and-a-half before the start of the 9:00 A.M. hearing, and others didn’t leave until almost 2:00 P.M. Some New Mexicans stood in line for more than three hours, waiting for their names to be called so they could

enter the building, stand before public officials in a small auditorium and speak for three minutes each.”

Then, in what the *Santa Fe New Mexican* ([October 17, 2017](#)) described as a “surprise turnaround,” the NM-PED announced that it would “revise its controversial proposal for new science teaching standards.” Four standards, two at the middle school level and two at the high school level, two concerning evolution or the age of Earth and two concerning climate change, would be restored to match the corresponding standards in the NGSS on which they were based, according to the announcement. The NM-PED subsequently indicated that the huge number of New Mexico-specific standards would be reduced.

But concerns about the content remained. The announcement failed to address the absence of the middle school standard about embryology’s relevance to evolution or the omission of “due to human activity” from a high school standard about Earth’s systems, for example. Moreover, the standards were still apparently limited to only performance expectations, excluding important elements of the NGSS. Ellen Loehman of the New Mexican Science Teachers’ Association told *Education Week* ([October 18, 2017](#)) that without those

Random Samples

with Greg Swift



Photo: Bob Heffner

Science education just had a big win in New Mexico when the state’s Public Education Department, known as NM-PED, reversed its decision to exclude some good stuff—and include some seriously bad stuff—in the state’s science standards (see *Excitement and Eventual Enlightenment*, p. 4). The

victory would not have come had it not been for the work of many dedicated advocates for science education in New Mexico, among them Greg Swift, a “semi-retired” alternative-energy researcher at the Los Alamos National Laboratory. Swift wrote a letter objecting to the standards as they were written and got over sixty fellow scientists at LANL to sign on. There is no doubt that this made an impression on the NM-PED—or that Swift has made an impression on NCSE over the last fifteen years he’s been a member. Let’s pick his brain!

First, quick word associations. What’s your immediate reaction to the following?

- *NCSE:* Champions of science and philosophy of science
- *NGSS:* An interesting experiment
- *Uncompromising:* What state science standards should be

Next, short answer. In 25 words or less...

- *Was NCSE helpful in this standard’s fight? You can be honest!* Vital. Does Glenn Branch ever sleep? He had analyzed NM-PED’s September 2017 draft science standards while I was still tying my shoelaces.
- *Did your colleagues need convincing to join you in your activism?* No, because NM-PED’s September draft was so obviously unscientific in the areas of climate change, evolution, and the age of Earth.
- *If you could change one thing about K–12 science education, what would it be and why?* Reduce poverty, so more kids can focus on school.
- *Finally, you work in a national science lab—how’s morale these days?* Los Alamos National Lab is remarkably diverse. So is morale.

—STEPHANIE KEEP

elements, it would be harder for teachers to implement the inquiry approach in their classrooms, thereby “relegat[ing] science to being taught as a textbook class.”

And then came a further surprise. “After facing an onslaught of opposition, New Mexico’s Public Education Department officials ... decided to adopt the Next Generation Science Standards ‘in their entirety,’” as the *Albuquerque Journal* ([October 25, 2017](#)) reported. Of the thirty-five New Mexico-specific standards originally proposed, only six would be added. Although it was not then clear that the NGSS’s disciplinary core ideas, science and engineering practices, and cross-cutting concepts would be included, on November 14, 2017, the *New Mexico Register* (containing the state’s administrative rules) was updated to specify that the NGSS, along with six New Mexico-specific standards, would be the New Mexico STEM-ready science standards.

NCSE was, of course, active both in public and behind the scenes. I talked with reporters from *Mother Jones*, the *Santa Fe New Mexican*, the *Albuquerque Journal*, the Associated Press, and *The New York Times*, providing them with background on the issues and comment on the

developments. Brad Hoge and I established a listserv for concerned New Mexican activists—all of whom were spectacular!—and NCSE participated in a coalition of activists led by Camilla Feibelman of the Rio Grande chapter of the Sierra Club. Nationally, we recruited the National Science Teachers Association and the National Association of Biology Teachers to protest the standards.

With NCSE’s help, New Mexico thus became the nineteenth state—along with Arkansas, California, Connecticut, Delaware, Hawaii, Illinois, Iowa, Kansas, Kentucky, Maryland, Michigan, Nevada, New Hampshire, New Jersey, Oregon, Rhode Island, Vermont, and Washington, as well as the District of Columbia—to have adopted the NGSS more or less out of the box. New Mexico’s students—like all students—deserve to learn about evolution, climate change, and the age of Earth in a way consistent with the scientific community’s understanding of those topics. It’s a relief, after all the furor, to be confident that New Mexico’s new state science standards will help to ensure that they will.

Glenn Branch is Deputy Director of NCSE. branch@ncse.com



PLACE & TIME

Ark Encounter



Ark Encounter is a \$100-million for-profit tourist attraction that opened to great fanfare on July 7, 2016. It is located in a rolling field in Grant County, Kentucky, just 70 kilometers (45 miles) from its accompanying attraction, the Creation Museum in Petersburg, Kentucky. The centerpiece of the 325-hectare (800-acre)

attraction is an impressive “life-size Noah’s Ark” that is built to specifications outlined in the Bible: 300 cubits (155 meters; 510 feet) long, 30 cubits (15.5 meters; 51 feet) high, and 50 cubits (23 meters; 85 feet) wide. Answers in Genesis, a co-owner of Ark Encounter, describes the ark as “an architectural and engineering

wonder” that is the largest timber structure in the world. Its stated goal is “Christian evangelistic outreach to bring the Ark of Noah’s day to life” so that visitors can understand “the reality of the events that are recorded in the book of Genesis.”

Cars and busses park in a 4,000-space parking lot, after which visitors ride a bus to the ark. After walking along the starboard side, you enter the ark’s bow and access ramps to its three levels. These three levels include 11,500 square meters (125,000 square feet) of exhibits that explain the how and why of Noah and the biblical flood, as well as information about Noah, his seven family members, and their adventure aboard the ark. Many of the 98 verses of Genesis are displayed in Ark Encounter, but visitors are told that “artistic license” was em-



NCSE is pleased to congratulate **Richard C. Lewontin**, a member of NCSE's Advisory Council, on receiving the Genetics Society of America's

Thomas Hunt Morgan Medal for lifetime achievement in the field of genetics for 2017. According to a March 23, 2017, press release from the GSA, "This award recognizes Lewontin's extensive impact on our understanding of evolution, a broad and deep influence that has shaped the field. An unprecedented 160 distinguished biologists co-signed a letter of support to nominate Lewontin for the Morgan Medal. ... While his many scientific contributions to evolutionary biology, including others not mentioned here, are themselves worthy of recognition, Lewontin has also made a large impact as a mentor to young scientists. His forty-six students and postdocs went on to have successful careers, and a large

proportion of the population geneticists working today can trace their academic legacy back to Lewontin's vibrant group." Lewontin is the Alexander Agassiz Professor of Zoology in the Museum of Comparative Zoology, Emeritus and Professor of Biology Emeritus in the Department of Organismic and Evolutionary Biology at Harvard University.



NCSE is happy to congratulate **Michael E. Mann** on receiving the Stephen H. Schneider Award for Outstanding Climate

Science Communication for 2017. Presented by Climate One, a project of the Commonwealth Club of California, the award is "given to a natural or social scientist who has made extraordinary scientific contributions and communicated that knowledge to a broad public in a

clear and compelling fashion." **Ben Santer**, a member of the award jury as well as a member of NCSE's board of directors, commented, "Mann has been a world leader in scientific efforts to understand the natural variability of the climate system, and to reconstruct global temperature variations over the past two millennia. This critically important work led to the famous 'hockey-stick' temperature reconstruction. The hockey stick provides compelling evidence for the emergence of a human-caused warming signal from the background noise of natural fluctuations in climate." Mann is Distinguished Professor of Atmospheric Science at Penn State University. His latest book, coauthored with Tom Toles, is *The Madhouse Effect* (Columbia University Press, 2016). A member of NCSE's Advisory Council, he received NCSE's Friend of the Planet Award in 2014.

—GLENN BRANCH

played throughout its many exhibits to tell its story.

The lowest level includes an animated exhibit of Noah's family praying at the onset of the flood, and cages containing sculptures of some of the "kinds" of animals believed to have been taken aboard the ark. These "kinds" are important, for after the ark landed in Ararat, they allegedly underwent rapid speciation to produce today's animals. The death and destruction caused by the flood are emphasized on this level. A soundtrack of murmurs, squawks, ominous noises, and crashing waves plays in the background.

Exhibits on the middle level describe the pre-flood world (e.g., the Garden of Eden) and how Noah and his family maintained the ark and the "fewer than 6,700 individual animals, most of them small" that were aboard. Not

all were small, however, and one set of videos shows how elephants powered the ark's sanitation system. Dioramas of Noah's workshop and the ark's blacksmith shop are found here, as well as more animals (including dinosaurs, all of which were vegetarians). Like those on the lower level, the animals here are inanimate sculptures. In fact, on most days, the only live animals inside the ark (aside from humans) are donkeys that sometimes wander around in a pen on this level.

Upper-level exhibits describe the living quarters for Noah and his family, and explain what happened inside and outside the ark during the flood. Some of these exhibits promote the Museum of the Bible, which recently opened in Washington DC. After learning how the flood has affected today's world, visitors are asked to accept Jesus as their savior.

Visitors exit via the gift shop where coffee, snacks, stuffed animals, t-shirts, DVDs, calendars, books, and all sorts of other souvenirs promoting the ark and young-earth creationism are for sale. Curiously absent from the shop is John C. Whitcomb Jr. and Henry M. Morris's *The Genesis Flood* (1961), the book that sparked the modern creationist movement.

Ark Encounter, which is open year-round, is at 1 Ark Encounter Drive in Williamstown, Kentucky. Tickets for adults cost \$40, tickets for children (ages 5 to 12) cost \$28, and parking costs \$10. Hours vary according to seasons.

Randy Moore is the H. T. Morse—Alumni Professor of Biology at the University of Minnesota, Twin Cities. His most recent book is *A Field Guide to the Scopes Trial* (Rhea County Historical and Genealogical Society, 2016). Rmoore@umn.edu



UPDATES

ncse.com/updates

CALIFORNIA

Californians overwhelmingly favor schools putting “greater emphasis on integrating science as part of the entire public school curriculum,” according to a [Berkeley IGS/EdSource poll of registered voters](#) conducted on-line in August and September 2017. The majority of respondents were unaware of the Next Generation Science Standards, adopted in California in 2013. However, once NGSS was described, 68 percent of the respondents said that they supported their emphasis on how scientific concepts fit together and are applied in today’s world.

IDAHO

At its August 10, 2017, meeting, the Idaho state board of education gave preliminary approval to a new set of state science standards. Earlier versions of standards discussing climate change and human impact on the environment were deleted by the state legislature, where legislators—particularly in the House Education Committee—complained that they failed to present “both sides of the debate.” The proposed standards, with a softened treatment of climate change, now return to the legislature for review in 2018.

NEBRASKA

At its September 8, 2017, meeting, the Nebraska state board of education voted 6–1 to adopt a new set of state science standards. The standards, according to the *Omaha World-Herald*, “will introduce climate change in Nebraska high school science classes for the first time,” since the previous standards, adopted in 2010, contained no specific references to climate change. But the treatment of climate change in the new standards deteriorated during the development process, obscuring the human impact on climate.

NEW MEXICO

There was a sustained public outcry across New Mexico through September and October 2017, after the state’s Public Education Department released a draft of proposed new state science standards. Based on the performance expectations of the Next Generation Science Standards, the proposed standards included weakened treatment of evolution, climate change, and the age of Earth. Ultimately, the department announced that it would adopt the NGSS in their entirety, without edits, and with the addition of six New Mexico-specific standards. (For details, see *Excitement and Eventual Enlightenment*, p. 4.)

Are there threats to effective science education near you? Or do you have any cause for celebration to share? E-mail any member of staff or info@ncse.com.

NEW YORK

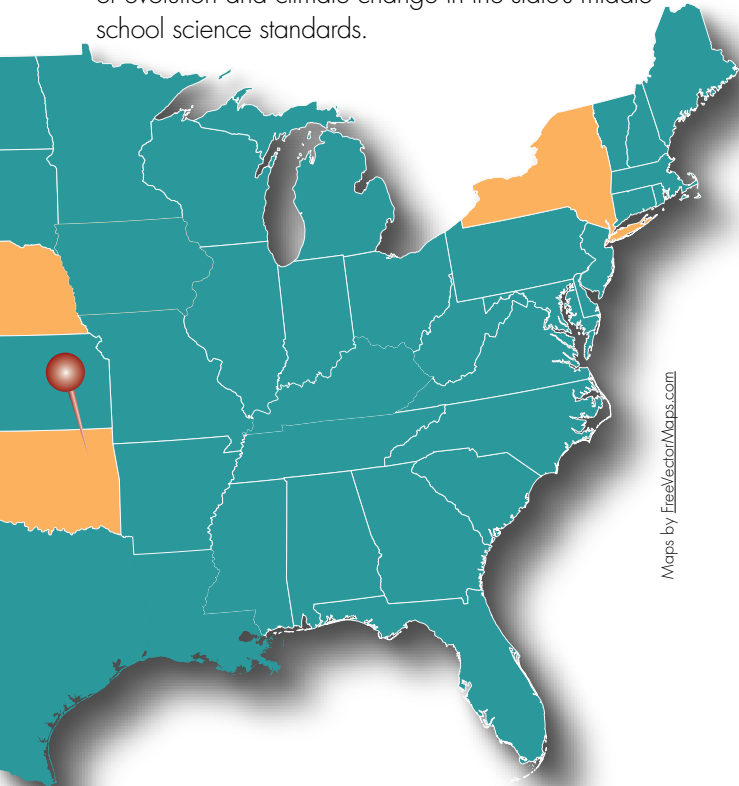
In August 2017, as the state of New York began its transition to a new set of state science standards that contain climate change, the New York State School Boards Association issued a new report, “When Politics Enters the Classroom: Teaching Climate Change in Schools,” to prepare school leaders and educators for the changes and challenges ahead. Included were the results of a survey of 603 New York school board members, 72 percent of whom supported teaching that humans contribute to climate change.

OKLAHOMA, OWASSO

Bob Linder, a teacher at Owasso High School in the Tulsa suburb of Owasso, was reportedly teaching creationism and disparaging evolution in his science classes. This prompted the Freedom from Religion Foundation to register a complaint with the district superintendent in January 2017. According to the FFRF, a reply from the district in June 2017 indicated “that Linder had voluntarily retired, and that appropriate actions had been taken by the district to prevent similar violations of staff infusing religious doctrine into curriculum.”

UTAH

On November 2, 2017, the Utah state board of education voted to begin the process of revising the state science standards for elementary and high school—albeit “[o]ver objections that national science education standards push a political agenda on global warming and do not include instruction of intelligent design as a counterpoint to teaching evolution,” according to the *Deseret News*. This was unsurprising, since there was controversy in 2015 over the inclusion of evolution and climate change in the state’s middle school science standards.



SOUTH KOREA

In September 2017, the nomination of Park Seong-jin to head the ministry of small- and medium-venture business in South Korea was derailed by a controversy over his involvement with the Korea Association for Creation Research, of which he was the director, reportedly resigning the day before his nomination. After a hearing before the National Assembly during which Park was questioned about his creationism, the assembly adopted a report finding him unfit for the position, and he withdrew himself from consideration.



UNITED KINGDOM, LONDON

Beis Yaakov Primary School, a state-funded school in Barnet, North London, serving girls from “strictly orthodox Jewish families,” is under fire in part because it boasts that it accepts “the biblical interpretation of creation as expounded by rabbinical teachings” and therefore teaches that the universe is 5778 years old while not discussing evolution “in any form.” In October 2017, the National Secular Society called on the Department for Education to investigate whether the school meets the requirements to receive public funding.



CANADA

Speaking at the Canadian Science Policy Convention in Ottawa on November 1, 2017, the new Governor General of Canada, Julie Payette, was critical of creationism and climate change denial: “Can you believe ... we’re still debating and still questioning whether humans have a role on the Earth warming up ... And we are still debating and still questioning whether life was a divine intervention or whether it was coming out of a natural process[?]” A mixture of condemnation and commendation followed.



Not Your Grandparents' Science Classroom

**Picture a science classroom.
Which comes closer to what you see?** ►



Classroom A: A teacher stands in front of seated students, perhaps delivering a PowerPoint lecture or writing on a whiteboard, or watching as students work on worksheets or as they diligently follow the steps of a lab exercise.

If you are not yourself a science teacher, or if you finished your K–12 education more than twenty years ago, I feel pretty confident about which classroom you imagined—Classroom A—and that’s because of the type of science education you yourself probably experienced. Your formal science instruction probably involved lots of textbook reading assignments and end-of-chapter questions, teacher lectures, and plenty of fill-in-the-blank quizzes and vocabulary tests. Maybe you dissected an earthworm; maybe you learned how to use pH paper. But what you probably did *not* experience was PBL—a science education practice based on decades of research and educational thinking.

So What Is PBL?

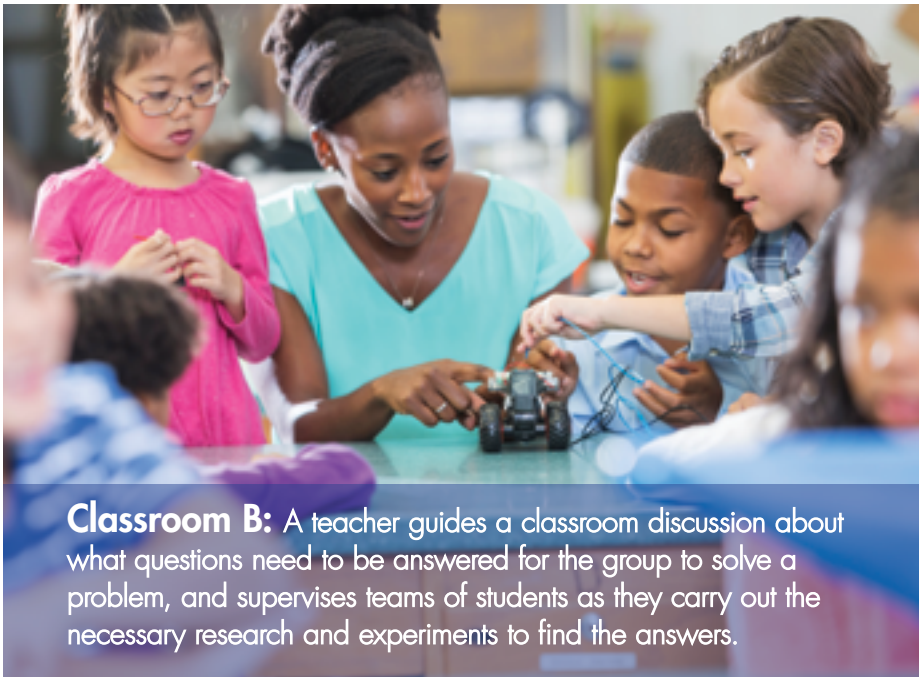
PBL most commonly stands for problem-based learning, but like any area of scholarship, there’s plenty of jargon to sort out. You may also hear about project-based learning (another PBL), place-based learning (yet another PBL), game-based learning (GBL), research-based learning (RBL), challenge-based learning (CBL), and design-based learning (DBL). All of these variations fall into the larger category of inquiry-based, or experiential, learning, which, in turn, falls under a larger educational philosophy called constructivism. Constructivism can be traced back to the “learning by doing” writings of John Dewey in the early twentieth century. The philosophy was tested and developed throughout the twentieth century by Jean Piaget, Lev Vygotsky, and many others.

Despite all of the varied names and different foci, these pedagogical frameworks all have something important in common: they are learner-centered. They all focus on the *process* of learning content and skills, promoting the teaching of science as it is practiced.

Science usually starts with an observation of a problem in need of explanation. There are many different paths forward from there (not, *nota bene*, a single “scientific method”). The next steps could be collecting relevant information on the problem, and then some iterative combination of performing experiments, observing, or building models. No matter which methods are used in what order, all scientific endeavors test hypotheses, that is, tentative explanations.

PBL asks students to employ these same methods and techniques in the classroom. In PBL, students undertake classroom projects that engage with issues and questions that are relevant to their lives. The approach requires students to constantly ask and refine questions, which may involve designing and conducting multiple investigations; gathering, analyzing, interpreting, and drawing conclusions from data; and reporting their findings.

PBL is based on thousands of studies of how students best learn science. Many science teachers have been implementing PBL for decades (whether they labeled it as such or not), and the Next Generation Science Standards are



Classroom B: A teacher guides a classroom discussion about what questions need to be answered for the group to solve a problem, and supervises teams of students as they carry out the necessary research and experiments to find the answers.

designed to be taught using PBL and associated pedagogical techniques. Nevertheless, the stereotype persists that science education remains a uniformly boring and authoritarian slog through the material. But if more people understood how problem-based learning approaches work, perhaps we could put a dent in both the stereotype and the defeatist attitude it engenders.

Identifying a Straw Man and Putting PBL to Use

“Teaching people more facts doesn’t change their minds,” goes the argument, quickly followed by the conclusion that science education will never succeed in increasing acceptance of societally controversial topics. Notice the tacit assumption there, though: that science education is simply a matter of teaching facts. That’s a straw man, because in fact science teachers are well aware that simply teaching facts (a model often called “the sage on the stage”) is not effective science education. Indeed, it is now so outmoded as to qualify as educational malpractice. Nevertheless, the stereotype is pointed to as an explanation for why science education has not, and never will, dent the stubbornly low rates of acceptance of climate change and evolution among the public.

Problem-based learning is the most effective way to teach all kinds of science, but it is especially crucial when teaching the topics that matter to us, topics about which students arrive in class with a big, messy mixture of misconceptions, fears, and pre-formed opinions. So at

NCSEteach, we know that developing and disseminating high-quality PBL-style classroom resources for the teaching of evolution and climate change and helping teachers learn how to use them will make a huge difference in the places where these topics are most contentious.

For example, a PBL activity on climate change might start with the question: “How might we know if the local climate has changed in the last 100 years?” Depending on where the lesson is being taught, and what ideas the students generate, they might be guided toward

data sets showing annual first frost dates or number of winter days below freezing or summer days above 38°C (100°F). They might look at regional maps of local shorelines, or species distributions, or Audubon bird counts. The students would chart the data, observe the trends, ask more questions, and see for themselves how climate changes have been manifested in their own communities. Important contrasts such as long-term versus short-term changes, extreme events versus averages, and weather versus climate could be introduced in immediately relevant contexts.

Can you see how such a lesson would be vastly more effective than a lecture on climate change? Can you take the next step and see how science communication to the general public might benefit mightily from paying attention to how the best science teachers are doing their jobs?

In the next year, you’ll be hearing a lot about how NCSEteach is working to bring this approach to teaching evolution and climate change to as many classrooms as possible, especially in the places where teaching these topics can be especially challenging. In the meantime, can we all just stop saying that science education can’t make a difference? The evidence is clear that it can.

Brad Hoge is NCSE’s Director of Teacher Support.
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news from the science booster clubs

Volunteer Networks: The Backbone of the SBCs

As we look back on nearly a full year of national operation of NCSE's Science Booster Club Program, it's both nice and interesting to see the similarities and differences among our many clubs. One notable similarity across all clubs is that every single one runs on the passion and commitment of its many volunteers. Volunteers are the reason the program has been able to spread across the country in 2017, and they are the reason we will be able to continue expanding in the new year. Right now, we have clubs functioning in Indiana, Iowa, Maryland, Ohio, Oklahoma, Nebraska, Tennessee, Texas, Virginia, and West Virginia. Very soon, Illinois, Kansas, and Massachusetts will be joining up. Let's learn more about the people making these clubs grow.

Medical Students: Volunteering on Exam Day!

NCSE staff member Brian Pinney has drawn on a diverse base of volunteers to help staff SBC outreach in Des Moines, Iowa. Since January 2017, Pinney has helped to organize community events that have reached more than eighteen thousand people. He couldn't have done it alone. Who are his most dedicated volunteers? Medical students. When these students first worked a crowd with our Genetics and Evolution exhibit, they were amazed by three things: how little people in their community knew about basic genetics, how much these same people wanted to learn, and how much people could learn in a short time with our hands-on activities. People had been so eager to interact with our volunteers that our booth had been pushed back several feet from the rest of the row. After this first event, the med school volunteers were hooked. Now they're regulars: even volunteering on an exam day, as seen in this photo from a women in science event in Des Moines.

The dedication of these medical students, seen here on an exam day, stems from their knowledge that they are making a difference in their communities.

Photo: Brian Pinney



Howard Hughes Medical Institute: Scientists Reaching Out

NCSE staff member Claire Adrian-Tucci has been hard at work on the ground mobilizing several independent groups of volunteers to serve an unbelievable 45,000 people and counting at events in the District of Columbia, Maryland, and Virginia. We want to give a shout-out to our volunteers from the Howard Hughes Medical Institute for their efforts organizing themselves to book and staff major events, carefully proofing and testing exhibit materials, and presenting their own research as well as SBC exhibits to the public. They say the no-conflict approach has changed the way they interact with the public for the better, increasing both their engagement with the public and the public's engagement with the scientific community.

Citizens in the Field: Community Organizers

Our staff members serve as powerful organizational nuclei in Iowa and DC, but many of our volunteers work largely independently, using SBC materials to help them start conversations in their communities about topics that matter to them. These conversations are tremendously important. Did you know that just one in three Americans report talking to family or friends about climate change either "often" or "occasionally"? That's one of the key findings from a [May 2017 report from the Yale Program on Climate Change Communication](#), and it's a number that has to be raised if our country is going to get serious about climate literacy.

One of our longtime volunteers, Tara Schremser, leads the Indiana club and can testify to the importance of face-to-face interactions. A stay-at-home mother of four young children, including a new baby, Schremser has used her close ties in her community to bring education to thousands of people. Through connections to local farmers' markets and the organic gardening community, Schremser is able to distribute information widely, reaching beyond her local connections to bring information about climate change into deeply conservative areas of the state. When people learn that there are other people in their area who want to know more about climate change, it can set off a chain reaction. Topics once taboo can become socially acceptable and public opinion can shift. Sometimes all you need is the right person to start the conversation.

Another volunteer who has been with us for the duration of the national expansion, Robert Marken Jr., works in rural Virginia, far from the metropolitan areas where our other Virginia volunteers can be found. He lives, works, and volunteers in a community that is largely populated by people who embrace creationism. He and his colleagues, both atheists and members of evolution-accepting faiths, want to bring more education and openness to their region, not tension and conflict. So they use SBC materials to provide friendly, non-judgmental, fun opportunities to talk about evolution and climate change at events in their community. By partnering with us, Marken has found a way to bring new kinds of conversations to the community he cares about, beginning conversations and expanding educational opportunities without losing friends.

University of Kansas and the Massachusetts Institute of Technology: Student-Driven Growth

Our newest groups of volunteers are just starting work with the SBC program, but they're not new to outreach. Graduate students at the University of Kansas, under the leadership of Andrew Mongue, have already designed and executed scientific outreach activities for kids, families, and adults; partnered with their local groups, including the Girl Scouts; raised funds for materials and supplies for community outreach events; and even obtained the necessary permissions to officially monitor and report on outcomes using surveys. Are your jaws dropping reading about this group's current efforts? They should be. These graduate students are dynamite! We're honored and excited to help the University of Kansas team bring our evolution education materials to Kansas.



Graduate student SBC volunteers from the University of Kansas.
Photo: Andrew Mongue

We're also eager to start work with MIT, where a diverse group of graduate students under the leadership of Makayla Betts is working to organize around the goal of replicating the success of our original, strongest, and hardest-working crew: the University of Iowa graduate students. By following the trail Ulowa has blazed in engaging diverse informal partners, school districts, and civic institutions, our MIT volunteers hope to test the viability of our model for replication and expansion in more urban environments.

Thank You to Our Volunteers!

Our SBC volunteers contribute an incredible amount of time to the clubs. Without their passion, their time, and their labor, the program would not run. They make the choice, over and over again, to help educate their communities, and to help us. From all of us at NCSE, thank you. Cultural change starts with conversation. And the conversation starts with you.

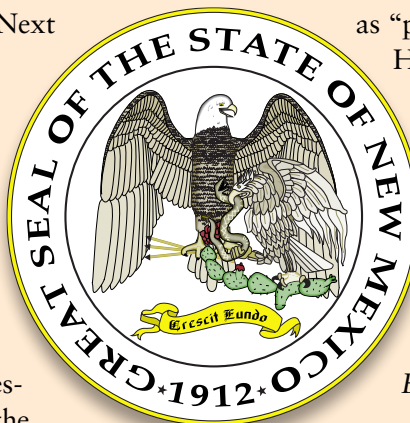
Emily Schoerning is the NCSE Director of Community Organizing and Research. schoerning@ncse.com



WHAT WE'RE UP AGAINST

External Cheerleading for the Losing Team

When the New Mexico Public Education Department proposed a new set of state science standards based on the performance expectations of the Next Generation Science Standards but edited to weaken the treatment of evolution, climate change, and the age of Earth, there was widespread speculation that out-of-state ideologues were responsible. Not as far as I could tell. Still, the “intelligent design”—promoting Discovery Institute described one of the problematic proposed changes with regard to evolution—which seemed to resonate with its approach of encouraging the



misrepresentation of evolution as scientifically controversial under the guise of “analysis” and “critique”—as “positive,” while the climate change-denying Heartland Institute described the problematic proposed changes with regard to climate change as “in line with our scientific understanding of historic temperature fluctuations.” Fortunately, the department was convinced to adopt the NGSS in their entirety, without edits, and with the addition of six New Mexico-specific standards (see *Excitement and Eventual Enlightenment*, p. 4).

—GLENN BRANCH

THE RNCSE REVIEW



An Inconvenient Sequel: Truth to Power

starring: Al Gore

directors: Bonni Cohen and Jon Shenk

reviewed by: John Abraham

scientists Eric Rignot or Konrad Steffen, or conversing with Miami city planners on ways to handle rising waters (south Florida may see 2 meters of sea level rise by 2100), the movie brings the implications of a changing climate home while providing projections for the future.

[T]he movie brings the implications of a changing climate home while providing projections for the future.

Later, Gore meets with people who have suffered through terrible and super-charged storms, such as recent typhoons in the Pacific. He lays clear the science that climate change is warming our oceans, providing extra fuel to make storms like Irma, Harvey, Sandy, and Maria more powerful. In these spots, his science is dead on.

The opening of the new film shows a sample of the misguided attacks on Gore, exclusively from conservatives in the United States. Most climate

scientists have not been attacked as consistently or for such a long duration as Gore, but the types of attacks he has had to handle are close cousins to what my colleagues and I experience on a regular basis.

Many conservatives, and some progressives too, claim that Al Gore made climate change political. But Gore was simply the first major political figure who took a stand on climate change. He would have loved to have been joined by anyone of any political persuasion. I firmly believe that the denialism we see from many conservatives in the US is partly because they cannot bring themselves to admit he was right. Instead, most US conservatives have tied their legacy to a climate denial movement that is causing and will cause irreparable harm to the planet, its biology, and human societies.

It isn't Gore's fault that so many conservative politicians have been bought by fossil fuel industries that have attacked climate science and climate scientists, that a faction of the Republican Party has stood in the way of the development of clean renewable fuels in the US, or that the few conservatives who have taken a principled stand have tended to pay a steep political price. That is on them.

You may wonder why I recommend people watch this movie. With the

Al Gore's new movie *An Inconvenient Sequel* is, in some ways, similar to his groundbreaking 2006 documentary *An Inconvenient Truth*, but different in other ways. Those key differences are why I recommend you watch it.

This movie successfully accomplishes a number of interwoven tasks. First, it gives some of the science of climate change, and Gore gets his science right. His first movie was more steeped in science and data than this one, so the science is somewhat abbreviated this time around. That's a good thing, because the science is settled that humans are causing current climatic changes and the science is settled that we are observing these changes throughout the natural world.

Rather than spend time recapping the incontrovertible evidence of anthropogenic climate change, this new movie focuses on its actual implications. Whether Gore is discussing Greenland's crumbling ice sheet with

current politicization of climate change, at least in the US (with a president and Congress in full denial mode), what reason is there to be hopeful? Well, other countries are taking up the slack, not only in basic science but also in deployment of renewable energy—an area of great potential. Even though, as shown in the movie, fossil fuel companies and some conservative politicians are trying to sabotage clean energy markets, they cannot deny the economics. It just makes sense to use clean and renewable energy.

Do you remember that iconic scene from Gore’s first movie, where he

followed greenhouse gas data upward using a scissors lift? The levels were literally off the screen. Well, that gloomy image is replaced in the new movie by an equally iconic but optimistic animation of how countries are installing clean energy.

A large part of the story deals with Gore’s personal journey. In many ways, this is mirrored in the journeys of climate scientists and people who care about the Earth’s environment. We have all experienced the ups and downs of this crisis; in fact, we’ve experienced them together whether we knew it or not. Interestingly, I have

come around to a cautious optimism that is identical to Gore’s.

People are investing in clean energy because it makes economic sense. This is the inflection point that makes the clean energy revolution unstoppable. That’s why I am optimistic. That’s why Al Gore is optimistic. That’s the message threaded through his movie. And it’s why you should be optimistic too.

John Abraham is a professor of thermal sciences at the University of St. Thomas and a climate researcher. With Dana Nuccitelli he writes the Climate Consensus—the 97% feature for the *Guardian*; the review is adapted from his November 15, 2017, column there. jabraham@stthomas.edu



*Dear NCSE,
I’m a new Science Booster Club volunteer and I’m doing my first event next month. I’m excited, but also worried about how to navigate situations that could escalate into conflict. What do you suggest?*

*Sincerely,
Apprehensive in Ames*

Dear Apprehensive,

I used to get anxious, too, so I definitely sympathize. But I have learned so much through doing dozens of these events about how to transform potential conflict into productive conversation, and I know you will, too. Here’s a recent example: While helping people work through a climate

change activity, I overheard one adult grumble to another, “It’s not that I don’t believe in climate change, but I don’t think it’s a big deal. I mean, wouldn’t we be doing something about it if it was a real problem?”

Instantly, the image of a fork in the road appeared in my mind. Down path #1, I’d snarkily reply, “Haven’t you heard of the Paris Accords?” and then start preaching from the climate change science literature, and he’d respond negatively and dig his heels in, and we’d both end up frustrated. I had to choose path #2.

So here’s what I did say: “What should we be doing if we thought that climate change was ‘a real problem?’”

He smiled. “Well, we should be living minimalist lifestyles, downsizing our homes and inviting people to live with us to be sustainable.”

“That would definitely help,” I said, remembering that it’s important to let people feel like they are being heard.

“So when can I let people know that they can move in with you?”

“Obviously I’m not going to do that!” he said, unsurprisingly. “But I do recycle and I’m looking into getting a more more fuel-efficient car.”

Bingo! “That’s great,” I said, “Climate change is a huge problem and there’s always more we can do, but it sounds to me like you are already part of the solution.” A few minutes later, he walked away feeling—I hope—empowered, not dejected. That’s what productive conversations can do.

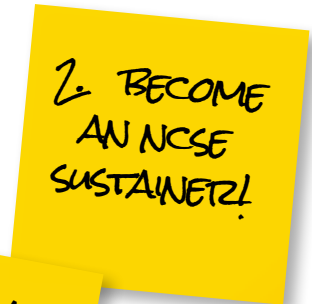
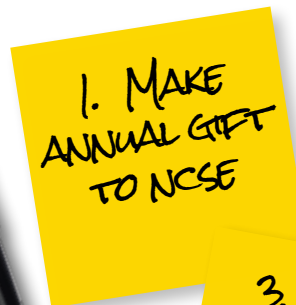
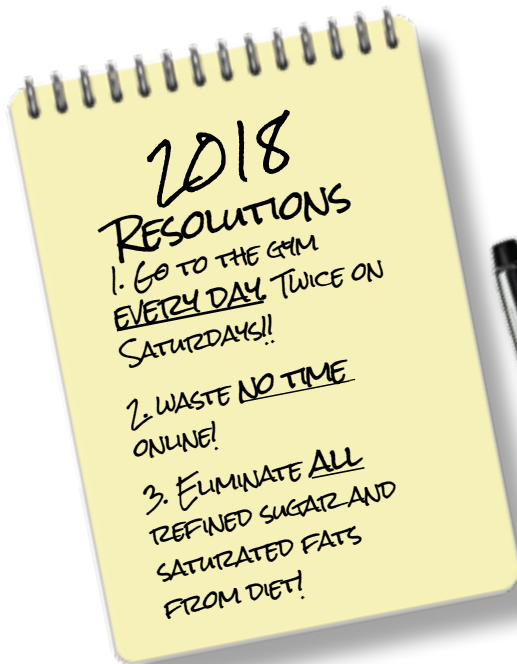
Apprehensive, I hope to see you along the path of productive climate conversations—and decreasing in apprehensiveness! Good luck at the event next month, and rest assured that these skills come more naturally with practice.

Have a question?
Write to us at askncse@ncse.com.

—CLAIRE ADRIAN-TUCCI

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